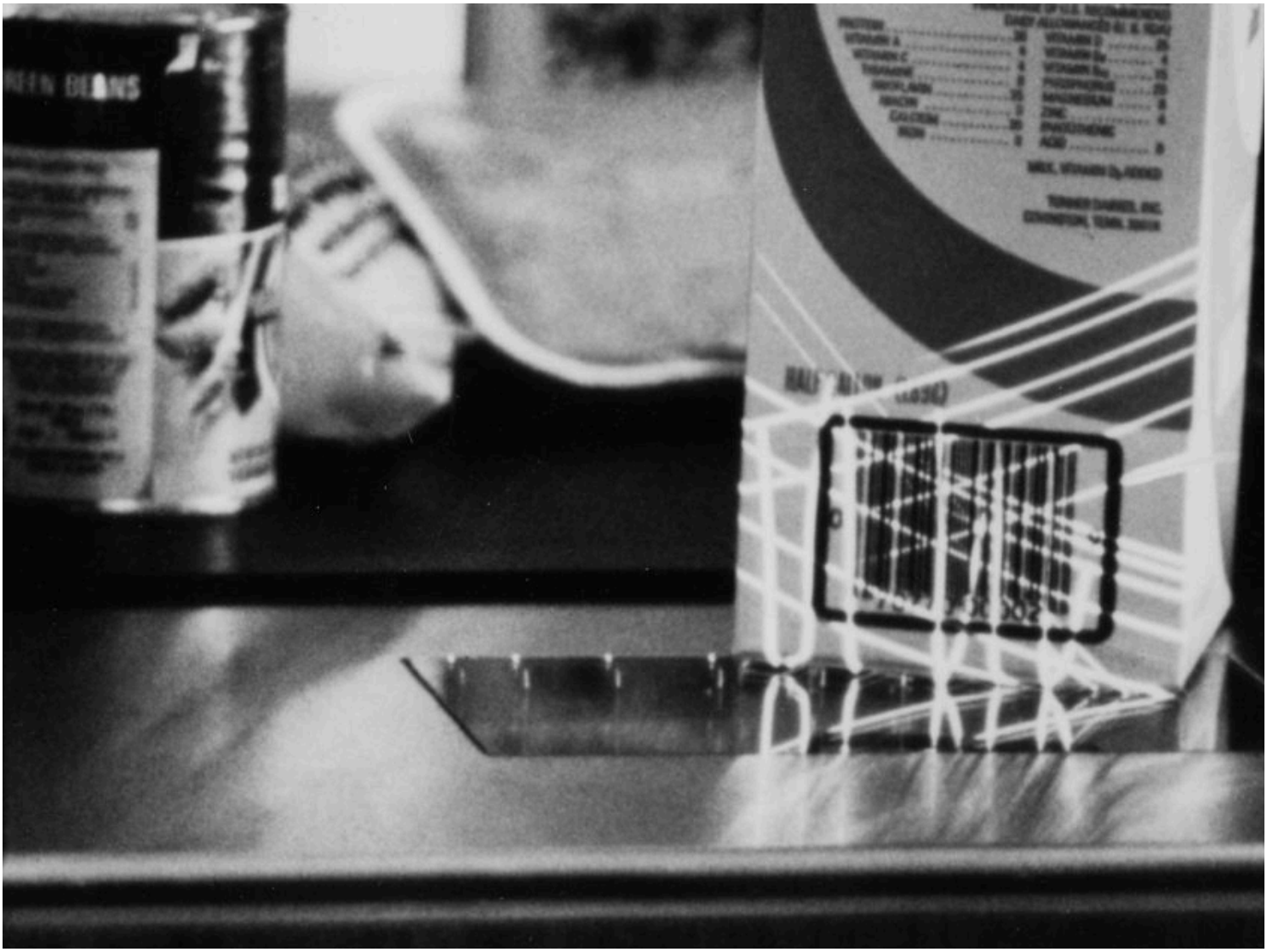
The UPC

The humble barcode fundamentally changed retailing, logistics management and global commerce



Quotient Ex. 1014
Quotient Technology, LLC et al., v. Intelligent Clearing Network, Inc
IPR2024-01323
Page 1 of 15

Overview

Origin story

An industry unites

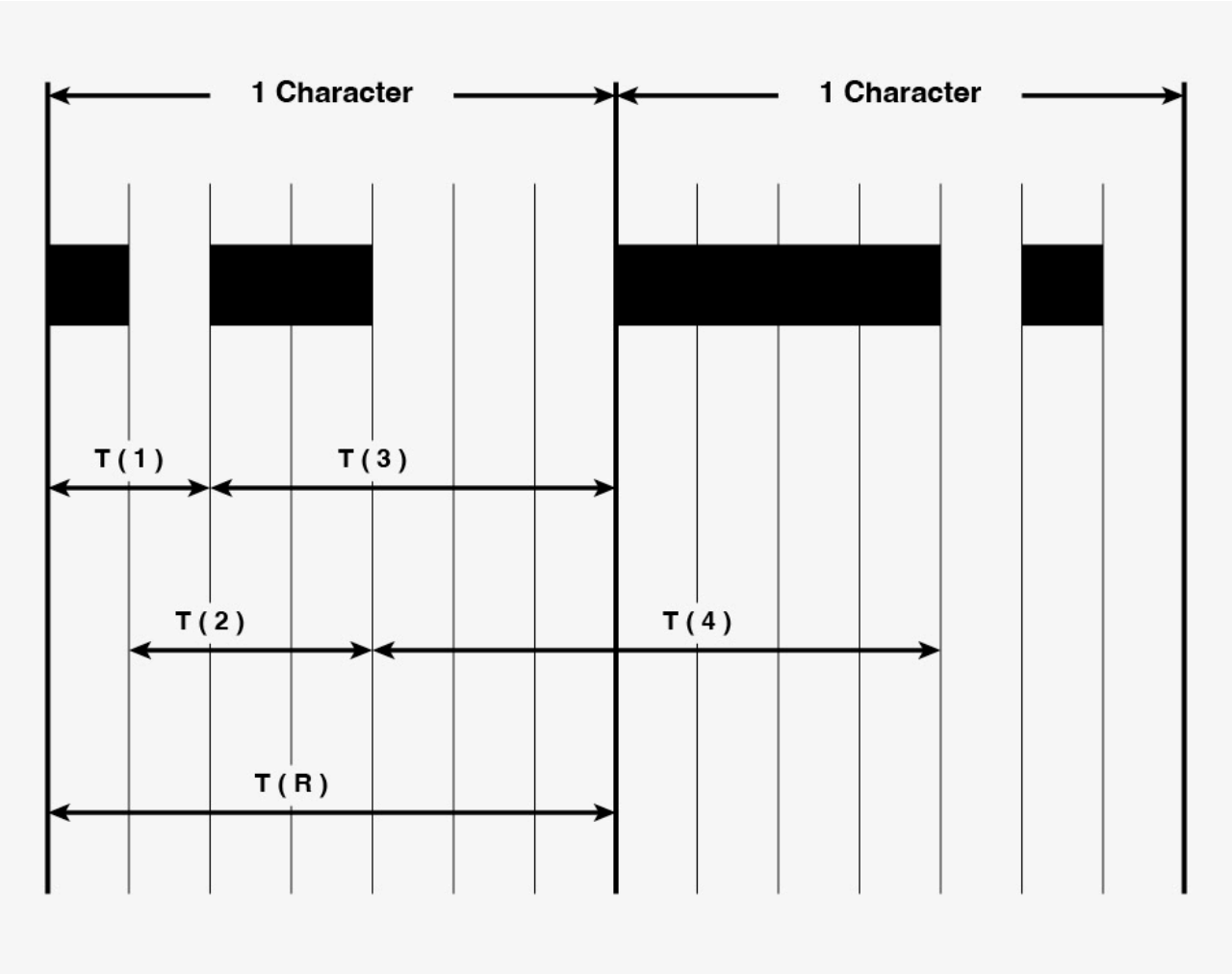
A chicken-and-egg dilemma

Connecting the dots

It’s all around you at the supermarket, yet you never give it a second thought. It’s the Universal Product Code, or UPC, the ubiquitous rectangular symbol comprising 30 black bars that streamlined checkout queues everywhere and went on to reinvent the grocery business. In the half century after its 1973 introduction, the UPC has transformed inventory management, smoothed the flow of global commerce and touched industries ranging from logistics to healthcare.

In 1970, grocery retailers and packaged goods manufacturers made a unified call for the creation of a standard machine-readable symbol to help supermarkets manage inventory. Electrical engineer George Laurer led IBM’s response, devising a reliable, scalable symbol with black bars that could be scanned by lasers in a point-of-sale system. It would enable the movement of products at speeds far faster than a human could enter prices into a register — while greatly reducing the costs of labor and human error.

Several industries had previously tried to devise a barcode-type system over the years. IBM’s approach succeeded for a number of reasons. First, its thoughtful design. Second, newly developed laser technology enabled it to be read easily. And perhaps most important, there was sufficient market demand to warrant the cost of R&D and implementation. As a result, Laurer’s barcode wasn’t merely adopted. It infiltrated tracking systems, kicked off a wave of data-management innovations, and streamlined all manner of transactions, from purchasing cans of soup to checking out library books, scanning airline boarding passes, and even tracking newborns.



A UPC code breakdown diagram

Origin story

A day at the beach

The simplicity of the UPC's design belies its complex path to invention. In 1932, Harvard business student Wallace Flint, whose father was a grocery wholesaler, wrote a thesis about how a company might automate the checkout queue. The concept, involving flow racks and punch cards, was intriguing but never practical. In 1948, Bernard Silver, a grad student at Drexel Institute of Technology, took up the problem after overhearing a supermarket executive plead with the dean to research an efficient means of encoding product data. Silver enlisted the help of Joseph Woodland, a fellow grad student and an

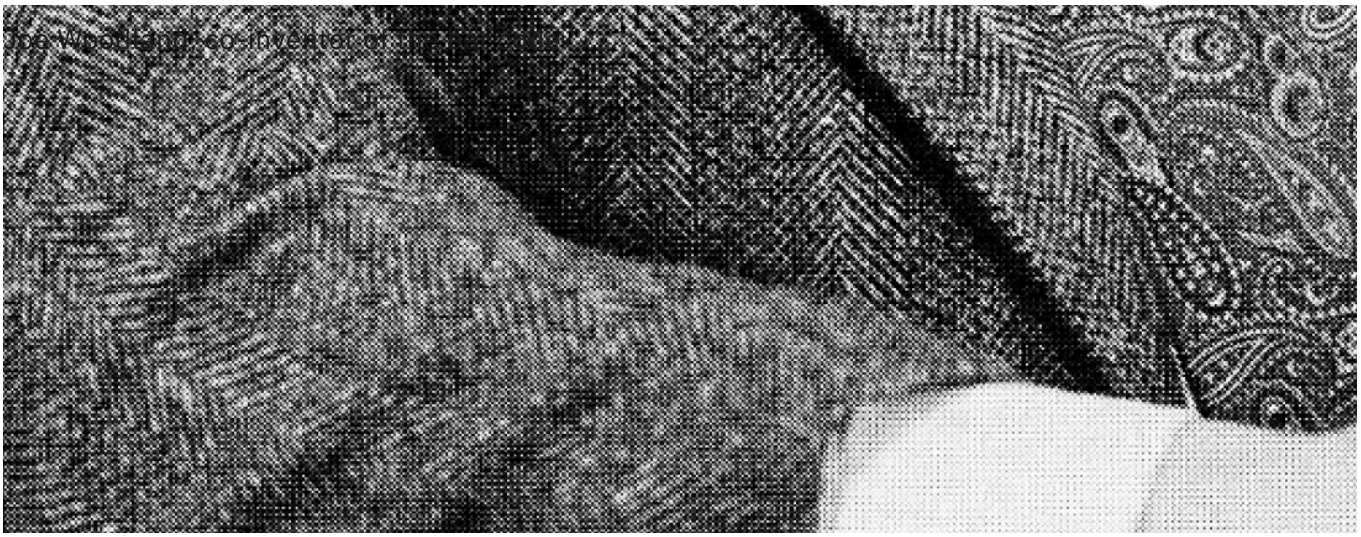
alum of the Manhattan Project. Woodland quit Drexel, sequestered himself at his grandfather's Miami apartment, and worked full time developing a solution.

A day at the beach turned into an "aha" moment. When Woodland ran his fingers through the sand and created four parallel but uneven lines, he realized that "wide lines and narrow lines" could represent data much like the dashes and dots of Morse code. He and Silver restructured the lines as a bull's-eye of concentric circles to make them more readable from any angle. They received a patent for their "Classifying Apparatus and Method" on October 11, 1952.

But technical hurdles would make it unviable: It required a 500-watt light and a special tube to convert the light into code. Silver and Woodland, who had been hired by IBM in 1951, sold the patent for just USD 15,000.



Quotient Ex. 1014
Page 5 of 15



An industry unites

Demand drives a barcode standard

By the late 1960s, the grocery industry was at a crossroads. The suburban supermarket business was booming, with annual sales exceeding USD 100 billion. It was also labor-intensive, slow, and rife with errors. Many of the 1.5 million grocery employees were tasked with tediously applying price tags and keying in codes for thousands of products. Worse, retailers had little visibility into their inventories or what consumers were buying.

A combination of market demand and technological advances, including a decline in the cost of computing power, created a tipping point. By 1970, grocery industry executives agreed that they needed a scannable symbol for the benefit of retailers, manufacturers and consumers alike. They formed the Ad Hoc Committee on a Uniform Grocery Product Code and asked for proposals. Recognizing the supermarket as the way into a major new market, IBM heeded the call.

At the time, RCA owned the patent for the bull's-eye design. But Laurer, who was asked to spearhead the project at IBM, knew the design couldn't overcome a major flaw — it was prone to smearing when printed. Laurer refused his manager's appeal to stick with the bull's-eye. "My nature and my training would not allow me to support something I didn't believe in," he said. He presented a linear alternative in a presentation that his 15-

year-old son helped prepare. IBM executives approved the design and gave Laurer license to proceed.

The format that Laurer and his team presented included 30 black and 29 blank vertical lines that wouldn't smudge. It could be scanned omnidirectionally with a laser, and it packed in all the necessary information in a footprint small enough to fit on most products. Using line width and spacing, the symbol conveyed both store and product information in 95 bits of data using binary code. (A series of numbers appears below the lines for human input, as necessary.) Joe Woodland's endorsement, combined with a prototype scanning system that the IBM team had designed for the company's presentation, swayed the symbol selection committee and subsequently helped convince hesitant business owners. It had been a long journey for the inventor, who joined IBM two decades earlier precisely because he thought the company was capable of developing such a solution.

The Universal Product Code was officially born on April 1, 1973, reflecting Laurer's original design with a few small tweaks. Soon after, the Uniform Product Code Council was established to organize standards and assign UPC numbers to packaged goods companies.

> [The Universal Product Code was officially born on April 1, 1973]

Quotient Ex. 1014
Page 7 of 15



George Laurer, who led IBM’s development of the UPC code



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A chicken-and-egg dilemma

Building trust in the system

IBM became one of the earliest vendors to market with a complete checkout suite. Its IBM 3660 Supermarket System included a POS terminal, a scanner and an in-store terminal that connected to a System/370 mainframe.

1974

On June 26, 1974, the first swipe of a UPC occurred at a Marsh's Supermarket in Troy, Ohio. It was a 67-cent pack of Wrigley's Juicy Fruit gum.

The UPC was not without skeptics in the beginning. Shoppers questioned its accuracy; labor unions worried about machines putting people out of work. Retailers questioned the wisdom of investing hundreds of thousands of dollars into a technology that would need to be printed on at least 75% of grocery items to break even. Manufacturers faced spending USD 200 million annually on labels.

Nevertheless, the grocery industry compelled suppliers to start using the code. IBM helped packaged goods manufacturers to acquire the technology to work with the UPC. And the benefits gradually became apparent. Retailers were able to follow inventory. Checkout lines were moving 40% faster. A record of purchasing history allowed retailers to match consumer demand with the right amount and type of supply. Clerks no longer had to laboriously key in every item. And profits rose. "It was cheap, and it was needed," Laurer told *The New York Times* in 2009. "And it is reliable."

1980s

In the 1980s, IBM and its competitors introduced the technology more broadly, enabling factories and libraries alike to track inventories.

Quotient Ex. 1014
Page 10 of 15

1990s

In the 1990s, handheld scanners made it easier to apply barcodes to items beyond cartons and cans. The addition of wireless technology laid the groundwork for end-to-end supply chain management.

Connecting the dots

The world harnesses data-rich supply chains

Quotient Ex. 1014
Page 11 of 15

It would have been difficult to imagine the many ways that an unassuming collection of vertical lines would change the world. Woodland certainly had no idea. “I didn’t know what the magnitude of the impact would be,” he once remarked.

The UPC provided a gateway to today’s massively digitized world. From a tin of mints to the most complex factory machinery, everything around us contains data. The ability to quantify, track and trace everything has empowered retailers, manufacturers, logistics companies and consumers to make ever more informed decisions. The success of the UPC ushered in not just RFID tags and QR codes, but also advanced analytics, predictive maintenance and machine learning.

“Barcodes were [a] crucial forerunner to the hybridity of our contemporary world,” notes Clemson professor and author Jordan Frith in *A Billion Little Pieces*. “They made physical objects digitally identifiable, bridging the gap between the materiality of objects and the digitality of back-end databases.”

An IBM team helped solve an industry’s long-standing conundrum, and commerce has never been the same since. Today, some 6 billion swipes of a barcode happen every day around the globe.

⌈ The success of the UPC ushered in not just RFID tags and QR codes, but also advanced analytics, predictive maintenance and machine learning ⌋

6 billion

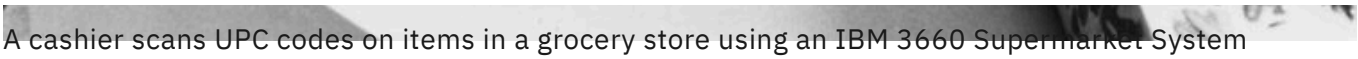
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swipes of a barcode happen daily around the globe

Quotient Ex. 1014
Page 13 of 15



Quotient Ex. 1014
Page 14 of 15



A cashier scans UPC codes on items in a grocery store using an IBM 3660 Supermarket System

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George Laurer

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Quotient Ex. 1014
Page 15 of 15